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INSTITUTE OF GAS TECHNOLOGY
AFFILIATED WITH ILLINOIS INSTITUTE OF TECHNOLOGY
CHICAGO 16, ILLINOIS

GAS ABSTRACTS

VOLUME 4
NUMBER 4

APRIL
1948

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GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year.—Printed in the U.S.A.

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1. GAS INDUSTRY

FPC Report

FPC-NATURAL GAS REPORT. *Pipe Line News* 20, 9-15 (1948) *February.*

The FPC has reported its opinions on the proposed revision of the Natural Gas Act of 1938. Two sharply different views were expressed. Mr. Smith and Mr. Wimberly recommend higher field prices and suggest free competition. Mr. Smith also suggested amendment of the act to make it clear that FPC does not have jurisdiction over production and gathering functions of interstate pipe line companies. Discrimination in price level between producers unaffiliated with natural gas companies and the pipe line companies is recognized by all FPC members although not considered as serious as by pipe line company officials. Mr. Olds and Mr. Draper oppose the amendments proposed in the Moore-Rizley bill on the grounds that exorbitant profits would result and that the Southwest is being unduly drained of its reserves.

J. D. Parent

Liquid Products from Natural Gas

Williams, C. R. LIQUIDS FROM NATURAL GAS. *Oil Gas J.* 46, 111, 188 (1948) *March* 25.

A break-down of the production of liquid products from natural gas during 1946 and 1947 is given. A 34% increase in LPG production took place in this interval. Further extensive expansion of the industry is anticipated in the next two years.

J. D. Parent

2. APPLIANCES

Burner Design

Jessel, R. FACTORS IN THE DESIGN OF PIN-HOLE GAS BURNERS. Institution of Gas Engineers Communication No. 327 (1947) November 25 and 26. 25 p.

The author presents the results of a study of some of the properties of the flames which result when unaerated coal gas burns as it emerges from small ports drilled vertically through the wall of a horizontal tube; an arrangement commonly known as a pinhole burner. The properties of the flame which have been considered are the height, amount of heat radiated, and the speed with which the flame will run along the tube during ignition.

E. F. Davis

Burner Design

Minchin, L. T. CURRENT PROBLEMS IN BURNER DESIGN AND FLAME BEHAVIOR. Institution of Gas Engineers Communication No. 328 (1947) November 25 and 26. 23 p.

The factors affecting flame behavior in aerated burners and which are not fully understood are discussed. These factors are; flame stability on turndown, variation of the aeration, smothering in products of combustion, causes for "blow off," and the effect of turbulence.

E. F. Davis

Heat Transfer Tests

Pease, W. C., Oglesby, S., Jr. and Freberg, C. R. PROGRESS REPORT ON HEAT TRANSFER. TESTS OF A BURIED COPPER PIPE. *Heating & Ventilating* 45, 87-90 (1948) *March.*

A series of heat transfer tests using the earth as a heat absorber from a buried copper pipe are described and interpreted as a step toward providing design data for sizing horizontal buried coil.

Authors' abstract

LP-Gas Appliances

Herr, F. A. LP-GAS PIPING AND APPLIANCE REGULATIONS. *Am. Gas J.* 168, 11-14 (1948) *March.*

A discussion of the proposed model ordinance covering the piping and installation of gas appliances utilizing LP-gas is given. The recommendations on ventilation of gas appliances are very stringent.

E. F. Davis

Radiant Heating Design

Vanderweil, R. G. PRACTICAL POINTERS ON RADIANT HEATING DESIGN. *Heating, Piping & Air Conditioning* 20, 97-98 (1948) *March.*

An attempt is made to correct some of the contradictory information on radiant heating systems.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Butane-Fueled Engines

Smith, B. BUTANE-FUELED ENGINES POWER ELECTRIC GENERATING PLANTS. *Butane Propane News* 10, 144-146, 148-149 (1948) *March.*

A description of the installation of LP-gas driven generator sets employed to operate control equipment used in distribution of electric power from Boulder Dam is given.

E. F. Davis

Combustion

McRae, H. C. FUNDAMENTALS OF COMBUSTION. *Ind. Heating* 15, 238, 240, 242, 244 (1948) *February.*

A simplified treatment of the theory of combustion applied to coal, oil and gas is given. The topics of air requirements, effect of fuel-air ratio, flame temperatures, and basic burner types are discussed in the most general terms.

H. R. Linden

High Temperature Furnaces

Thompson, A. J. TEMPERATURE DISTRIBUTION IN FURNACE WALLS OF VARYING THERMAL PROPERTIES. *Gas* 24, 48-49 (1948) *March.*

Some aspects of heat transfer in the design

of high temperature furnaces are given. Results obtained from the operation of typical insulated and uninsulated furnaces are shown.

E. F. Davis

Lumber Drying

Risser, R. R. THE USE OF NATURAL GAS IN THE KILN DRYING OF LUMBER. *Industrial Gas* **26**, 19-20, 30-31 (1948) *February.*

Gas is rapidly replacing steam kiln drying of lumber although many improvements are forthcoming. It is suggested that unit heaters be employed for drying since they have been successfully applied in other drying operations. Sketches of several typical kiln installations are given.

E. F. Davis

Power Turbines

Bencze, S. POWER TURBINES FOR NATURAL GAS EXPANSION. *Power Generation* **52**, 110, 112 (1948) *March.*

Natural gas expansion turbines have become an exceedingly important source of power in our oil fields. The low initial cost plus the improved overall efficiency, and the fact that no flame or spark is involved, are the main reasons for the popularity of this machine. The turbines are normally single stage and are used to drive generators, pumps, fans, blowers and other equipment.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Manufactured Gas

GAS LINKAGE BETWEEN A PETROLEUM REFINERY AND A GAS UNDERTAKING. *Coke & Gas (British)* **10**, 41-43, 63 (1948) *February.*

Approximately 600,000 cu ft of 890 Btu tail gases will be available from the Catarole oil cracking process at Partington. The gas will be purchased by the Manchester gas department and mixed with blue gas to produce 450 Btu mixed gas.

C. H. Riesz

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Booster Station

Mueller, A. V. COOLING WATER REQUIREMENTS FOR NATURAL GAS BOOSTER STATIONS. *Am. Gas J.* **168**, 35-37 (1948) *March.*

See *Gas Abstracts* **4**, 29 (1948) *February* for abstract.

Carburetor

Jones, S. P. DESIGN FOR CARBURETION. *LP-Gas* 8, 24-25, 60 (1948) *March.*

A detailed description of a gas vaporizer, flow control valve and carburetor for use on an internal combustion engine is given. The carburetor may be used with LP or natural gas.

E. F. Davis

Centrifugal Compressor

Karassik, I. J. PROCESS ENGINEER'S GUIDE TO THE CENTRIFUGAL COMPRESSOR—V. *Chem. Eng.* 55, 134-137 (1948) *February.*

Methods of determining compressor characteristics are discussed.

J. D. Parent

Clay Removal

Cardwell, P. H. CHEMICAL REMOVAL OF CLAYS. *Oil Gas J.* 46, 130-133 (1948) *February* 28.

The presence of clays and mud cakes in the critical area of the bore hole of gas and oil wells may restrict and even decrease production. Clays are usually present due to mud deposited during rotary drilling, but they also may have been contained in the original formation. Aqueous solutions of HC1 or $CaCl_2$ put in contact with the clays cause a partial flocculation of the clay due mainly to a base exchange, and a small portion of the clay dissolves; this results in a slight increase in permeability of the formation. Mud acid containing HF, HCl, and other chemicals actually dissolves the mud cake resulting in its removal and restoration of original permeability of formation.

E. Strong

Condensate Production and Cycling

Jones, P. J. CONDENSATE PRODUCTION AND CYCLING. PART 14—ECONOMICS OF CONDENSATE PRODUCTION. *World Oil* 127, 148-150 (1948) *March.*

An elementary economic analysis is presented with the aim of enabling one to estimate the most economical rate of production.

J. D. Parent

Cycling

Bennett, E. O. CYCLING AT HIGH PRESSURES VS. DEPLETION AND CYCLING AT LOW PRESSURES. *World Oil* 127, 160, 162, 166, 168 (1948) *March.*

See *Gas Abstracts* 3, 207 (1947) *December* for abstract.

Cycling

Miller, M. G. and Lents, M. R. PRACTICAL ASPECTS OF CYCLING. *Oil Gas J.* 46, 106, 109, 110 (1948) *March* 11.

Interesting general information on cycling is presented.

J. D. Parent

Miller, M. G. and Lents, M. R. PRACTICAL

ASPECTS OF CYCLING. *Oil Gas J.* **46**, 111-112, 119 (1948) *March* 18.

Factors to be considered before a cycling project is started are presented in a very general way.

J. D. Parent

Load Forecasting

Sweeney, E. L. LOAD FORECASTING. *Gas Age* **101**, 21-24 (1948) *February* 19; *Gas* **24**, 38-41 (1948) *March.*

A description of the methods employed in estimating daily sendouts, at Boston Consolidated, for the purpose of planning manufacturing operations is given. A certain amount of weather forecasting backed by weather bureau data is necessary to predict daily outputs in advance. After several years' experience, the data obtained and the charts devised provided a reliable method for predictions.

E. F. Davis

LPG Installation

McCarthy, C. J., Jr. FOUR-WAY AUGMENTATION WITH LP-GAS. *Gas* **24**, 38-39 (1948) *February.*

A discussion of an LP-installation on the Hartford Gas Company properties for use in enriching, peak shaving, reforming and gravity control is given.

E. F. Davis

LPG Recovery

McCullough, G. W., Hackmuth, K. H. and Miller, A. J. MODERN PROCESS METHODS TO IMPROVE LPG RECOVERY. *Oil Gas J.* **46**, 116-118, 196, 198, 200 (1948) *March* 25.

Requisite of earlier absorption plants was the production of 26 RVP gasoline except in summer when 12 RVP butane-free gasoline was desired. Increased recovery of LPG has brought many changes in design. Absorber pressure is generally higher especially where pressure maintenance is practiced. There is a trend toward cooler lean oil even to refrigeration, especially in the form of intertray cooling. Some reduction in moisture of the dry-gas is accomplished in this manner, also there is a more favorable ratio of recovered heavier constituents to absorbed lighter gases in this case than is true when increased absorber pressure is employed. There has been a tendency toward absorption oils of lighter molecular weight but there is danger of increased entrainment and retrograde losses. There has been an increase in the number of trays used in absorbers. Increased circulation rate of lean oil is advantageous, but involves increased power, heating and cooling. In general this latter procedure involves proportionally greater absorption of light gases including H_2S. Stripping is an expensive operation and designers have attempted to reduce these costs to a minimum. One scheme recently employed is to use multiple absorption. This means applying enough completely stripped oil at the top of the absorber to achieve the desired recovery of C_5-plus and to provide at a lower point a greater supply of partially stripped oil. Cold flashing accomplishes partial denuding for the one stream while the remainder of the rich oil is completely denuded in the usual manner. A graph is provided to show the effectiveness of this process for a given operating condition. A flow sheet for this process as well as one employing desorption are given. Deep absorption by any method means increased absorption of lighter gases and simple venting means high cost of recycling, recompression and reabsorption. Flash drums provide only one stage of separation and this is currently being replaced by the following procedures: rich oil deethanizing, two stage stripping, rich oil desorption and lean oil presaturation. The first of these is the removal of methane and ethane by fractionation of the rich oil. In this case the gas released passes to an absorption section to

recover C_3-plus. Two stage stripping means denuding in two columns operating at successively lower pressure, say 150 psi and 50 psi. In desorption cold rich oil is contacted by vent vapor, rich in C_3 and C_4, resulting in an exchange reaction with lighter gases. Presaturation means passing lean oil before it is sent to the absorber to a tower to contact vent vapors at the highest possible pressure, thence to coolers and to the absorbers. Liquid pumping thereby replace vapor compression. Some factors significant in process selection are presented. Comparative data are presented for a particular illustration.

J. D. Parent

Natural Gas for Enrichment

Bellamy, C. R. THE ECONOMY OF NATURAL GAS AS AN ENRICHING MEDIUM. *Gas Age* **101**, 28-29, 64, 66, 68 (1948) *March* 4.

It is shown that where natural gas is available at three cents a therm it can be used in carburetted water gas sets to replace gas oil with a considerable saving in raw material cost. A chart giving the cost savings per Mcf per day when using natural gas is given.

E. F. Davis

Pressure Maintenance

Hoss, R. L. CALCULATION OF THE EFFECT OF PRESSURE MAINTENANCE ON OIL RECOVERY. *World Oil* **127**, 129-130, 132, 134, 136 (1948) *March.*

Basic equations are presented together with an illustrative problem. The aim is to enable one to plan the most economical withdrawal program.

J. D. Parent

Transmission

Miller, B. GAS TRANSPORTATION SYSTEM CALCULATIONS. Part III—No. 22. *Gas Age* **101**, 30-37 (1948) *February* 19.

This is a very simple and clear discussion of compressor calculations. Such topics as clearance, volumetric efficiency, and power requirements are discussed.

J. D. Parent

Miller, B. GAS TRANSPORTATION SYSTEM CALCULATIONS. Part III—No. 23. *Gas Age* **101**, 32-37 (1948) *March* 4.

Certain elementary considerations relevant to gas compression are presented.

J. D. Parent

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Aromatics Determination

Lipkin, M. R., Hoffecker, W. A., Martin, C. C., Ledley, R. E. AROMATICS IN PETROLEUM FRACTIONS. *Anal. Chem.* **20**, 130-134 (1948) *February.*

A method is given for determining the per cent of aromatics in an oil or hydrocarbon mixture boiling above 200°C by percolating through silica gel. One hundred ml of sample is diluted with an equal volume of pentane and percolated through a kg of silica gel in a glass tube. Suit-

able desorbents, such as benzene and methyl alcohol, are used to desorb the aromatic and non-aromatic fractions. The solvents are distilled off the two fractions and volumes of aromatic and non-aromatic fractions are determined. Results are discussed and tables presented to show an accuracy of 1% in the volume per cent of aromatics and non-aromatics.

R. D. Clevenger

Catalyst Activity Approximation

Scheumann, W. W. and Rescorla, A. R. THE AROMATIC ADSORPTION INDEX AS A RAPID METHOD FOR APPROXIMATING CATALYST ACTIVITY. *Petroleum Refiner* **26**, 119-121 (1948) *December.*

The ability of a cracking catalyst to absorb aromatic hydrocarbons from a specified hydrocarbon mixture is used as a basis for a rapid evaluation of cracking catalyst activity. Maximum deviation between the rapid method and a standard laboratory catalyst evaluation is about ±2% gasoline yield where the standard yields fall within the range of 15 to 29% gasoline yield.

C. H. Riesz

Chemicals from Petroleum

Rossini, F. D. PURE COMPOUNDS FROM PETROLEUM. *Anal. Chem.* **20**, 110-121 (1948) *February.*

A description of the work at the National Bureau of Standards dealing with the separation of pure compounds from petroleum and with the purification and determination of purity of hydrocarbons, is presented. This report summarizes this work as carried out in cooperative investigations with the American Petroleum Institute, providing some substance to the philosophy propounded, and reducing to actual practice some of the principles described in the preceding papers of this symposium. The first part of this report surveys the problem of determining the composition of natural petroleum in terms of its individual components, and the latter part describes the work of purifying and determining the purity of hydrocarbons required for use as standard samples for calibrating analytical apparatus and instruments and for measuring needed physical, thermodynamic, and spectrographic properties.

Author's abstract

Cracking Catalysts

McReynolds, H. BENCH-SCALE METHOD FOR DETERMINING ACTIVITY OF CRACKING CATALYSTS IN POWDERED FORM. *Petroleum Refiner* **26**, 94-98 (1947) *December.*

A rapid method for determining catalytic activity of powdered form catalyst on a bench scale is offered. The Texas D + L has been correlated with the Jersey D + L and the correlation is included. The method also provides data from which the gas and carbon producing tendencies of catalysts may be determined.

H. Dirksen

Fischer-Tropsch Catalyst

Weller, S., Hofer, L. J. E. and Anderson, R. B. THE ROLE OF BULK COBALT CARBIDE IN THE FISCHER-TROPSCH SYNTHESIS. *J. Am. Chem. Soc.* **70**, 799-801 (1948) *February.*

Cobalt catalysts carbided 70% or more before use in Fischer-Tropsch synthesis were inactive. After removal with hydrogen, the catalyst showed normal activity. Partially carbided cobalt catalysts retain the carbide structure even after several days of synthesis. Since catalysts

used without precarbiding show no carbide by X-ray analysis, it appears that bulk carbide is neither formed nor destroyed as part of the synthesis. Other X-ray considerations indicate that extensive bulk carbide formation does not occur during synthesis. Thus, bulk cobalt carbide is neither an intermediate nor a catalytically active substrate for Fischer-Tropsch synthesis.

C. H. Riesz

Fischer-Tropsch Synthesis

Craxford, S. R. THE FISCHER-TROPSCH SYNTHESIS WITH COBALT CATALYSTS. *J. Soc. Chem. Ind.* (*British*) **66**, 440-444 (1947) *December.*

Scientific aspects of research work with Fischer-Tropsch cobalt catalysts in Germany and elsewhere are examined and an overall development of the catalyst functions and mechanism is presented. Thoria acts to suppress the rate of hydrogenation of the catalyst substrate and thereby the undesirable formation of methane. Magnesia, having the same molecular volume as cobalt oxide, forms mixed crystals and thereby protects the cobalt from sintering. Kieselguhr maintains the fine structure of the cobalt and also the porosity of the individual granules. Catalyst should be reduced quickly (40-120 minutes), at low temperature (350-400°C) and at a hydrogen rate of 5000 volumes of hydrogen per hour per volume of catalyst. Best results are obtained if the cobalt is not completely reduced, 65 to 70% being the optimum range; since an equilibrium value of 75% results regardless of the original reduction state of the catalyst, technical catalysts are reduced only about 55-65%. The reacting gases reach the surface directly in atmospheric synthesis by gaseous diffusion whereas in medium pressure synthesis, the synthesis gas dissolves and diffuses through wax filling the catalyst pores. Because of different solubilities and rates of diffusion of hydrogen and carbon monoxide, a ratio of 1.5 to 1 gives best results at medium pressures, 2 to 1 being optimum at atmosphere pressure. Cobalt atoms appear to be isolated and do not form part of a cobalt lattice. Reaction with carbon monoxide does not result in bulk cobalt carbide. Rather it is believed that carbon is chemisorbed (surface carbide) to give an array of interacting methylene groups on the surface. The composition of the products, obtained by desorption from this array, depends upon the reaction conditions.

C. H. Riesz

Specific Gravity of Petroleum Liquids

Reynolds, P. M. EFFECT OF TEMPERATURE AND PRESSURE ON SPECIFIC GRAVITY. *Oil Gas J.* **46**, 96, 98, 102 (1948) *March* 11.

Charts and tables are given to amplify the method originally presented by K. W. Watson and associates, for determining the effect of temperature and pressure on the specific volume of petroleum liquids.

W. K. Zahray

Synthetic Fuels

Bland, W. F. TWO DECADES OF RESEARCH PUT INDUSTRY ON TOP OF SYNTHETIC FUELS PROBLEM. *Petroleum Processing* 3, 203-206 (1948) *March.*

The activities of various private companies in the field of synthetic liquid fuels are summarized. The companies prosecuting research in the field include Standard Oil Development, Texas, Standard Oil Company (Indiana), Standolind Oil and Gas, Hydrocarbon Research, M. W. Kellogg, Cities Service, Gulf Research and Development, Standard of California, Sinclair, Socony-Vacuum, Shell Development, Union Oil, Sun Oil and Phillips Petroleum.

C. H. Riesz

7. ANALYTICAL METHODS AND TESTS

Gaseous Hydrocarbon Determination

Murdock, R. E., Brooks, F. R. and Zahn, V. DETERMINATION OF GASEOUS HYDROCARBONS. *Anal. Chem.* **20**, 65-67 (1948) *January.*

The preparation and use of precipitated copper oxide (containing 1% iron oxide) for the determination of gaseous hydrocarbons is described. Optimum conditions of temperature, rate of oxygen supply, and particle size employed for producing and activating the copper oxide-iron oxide mixture were experimentally investigated. Test data is given to show that methane, propane, isobutane, and n-butane are completely oxidized at 700°C by passage over this specially prepared combustion agent and that the analysis of these hydrocarbons by this method results in accuracy and precision comparable to that obtained with the slow combustion pipette or with platinized silica gel. Advantages of the method employing the copper oxide mixture are: (1) the need for a source of pure oxygen is eliminated, (2) the measurement of oxygen taken for combustion is not required, (3) explosion hazard is greatly reduced, and (4) relatively low temperatures are needed—220°C for hydrogen and 700°C for the hydrocarbons mentioned above.

H. Hakewill

Hydrogen Sulfide Determination

Thomas, H. H. CONTINUOUS DETERMINATION OF SMALL CONCENTRATIONS OF HYDROGEN SULPHIDE IN TOWN GAS. *Gas J.* (*British*) **253**, 251 (1948) *February* 4; *Gas World* (*British*) **128**, 182-184 (1948) *January* 31.

The authors describe in some detail the principles and operation of an apparatus for measuring traces of H_2S in town gas. H_2S is determined with this instrument by passing the gas through a small disc of absorbent paper impregnated with lead acetate so that a stain of measurable density is formed. It is claimed that less than 0.1 ppm of H_2S can be determined accurately by this procedure. If desired, the stain formed may be indicated and recorded photoelectrically and an arrangement for doing this is discussed.

H. Hakewill

Mass Spectrometer Analysis

Brown, R. A., Taylor, R. C., Melpolder, F. W. and Young, W. S. MASS SPECTROMETER ANALYSIS OF SOME LIQUID HYDROCARBON MIXTURES. *Anal. Chem.* **20**, 5-9 (1948) *January.*

Applications of the mass spectrometer method of analysis to normally liquid hydrocarbons in the C_5 to C_8 range are discussed. Accuracies attainable for individual compounds in a number of different synthetic mixtures are given and typical analyses of several hydrocarbon fractions in gasoline boiling range are shown. It is concluded that a substantial number of the paraffins, cycloparaffins, and aromatics occurring in this region may be individually determined. Olefins and cyclo-olefins, on the other hand, may be determined individually only to a limited extent at present.

Authors' abstract

Oxygen Determination

Laitinen, H. A., Higuchi, T. and Czuha, M. POTENTIOMETRIC DETERMINATION OF

OXYGEN. USING THE DROPPING MERCURY ELECTRODE. *J. Am. Chem. Soc.* 70, 561-565 (1948) *February.*

A simple, rapid and sensitive potentiometric method for the determination of traces of oxygen in gases or in solution, based upon measurement of the null potential of a dropping mercury electrode, has been developed. The maximum potential difference developed during the growth of the mercury drops varied linearly with oxygen concentration over a potential range of zero to 300 millivolts, in the presence of maximum-suppressing agents. The potential varied as the square root of the drop time and was independent of the rate of flow of mercury through the capillary at a constant drop time. Using 0.1 N potassium chloride, with a trace of methyl red as a maximum suppressor, the method was sensitive to 0.01 per cent of oxygen in a gas; linear relationship was attained over the range of zero to 1 per cent. of oxygen. The sensitivity of the method varied with changes in the capacity of the electrical double layer at the mercury solution interface caused by changes in electrolyte concentration or by traces of capillary-active materials.

Excerpt from article.
H. Hakewill—Reviewer

Particle Size Measurement

PARTICLE SIZE MEASUREMENT. *Nature* 161, 313-314 (1948) *February* 28.

A simple, rapid method for measuring mean diameters of the particles of a powder is described. The only apparatus required is a leveling bulb, reservoir, U-tube, mercury, and a non-polar liquid such as carbon tetrachloride. An equation that relates the mean radius of particles to physical properties of the non-polar liquid employed and the powder under consideration has been developed and found to apply when certain conditions are attained in the measuring system. Tests on a powder known to consist of nearly spherical particles of 0.017 mm average radius gave results having a mean error of 0.0008 mm or about 5%.

H. Hakewill

Specific Dispersion of Hydrocarbon

Hindin, S. G. A RAPID CALCULATION OF THE SPECIFIC DISPERSION OF SATURATED HYDROCARBONS. *Petroleum Refiner* 27, 91 (1948) *January.*

In various chemical methods of determining, the four major classes of hydrocarbons (olefins, aromatics, naphthenes, and paraffines) in liquid petroleum fractions, it is desirable to make certain that removal of the olefins and aromatics is complete. An Abbé type refractometer can be used for this purpose by preparing a chart of density ranges for which the refractive index times 10^4 is from 95 to 100 at given refractive index and drum readings. It is sufficient to choose refractive index readings from 1.350 to 1.510 and drum readings from 42.00 to 43.00 at intervals of 0.010 for the indices and 0.05 for the drum readings. By determining the density of the supposedly unsaturates-free sample and then checking by use of the chart, the drum reading, and the refractive index, an error in the work can be detected. The chart in this publication was prepared for a Valentine refractometer but similar charts can be made for other models.

H. R. Linden

Sulfur Determination

Alicino, J. E. MICROVOLUMETRIC METHOD FOR DETERMINATION OF SULFUR IN ORGANIC COMPOUNDS. *Anal. Chem.* 20, 85-86 (1948) *January.*

Sulfur in organic compounds is determined by

a modified Pregl combustion method and the effluent gases absorbed in H_2O_2. The sulfuric acid formed is converted to a salt with a known volume of sodium hydroxide and this sulfate is then titrated with $BaCl_2$ using tetrahydroxyquinone or rhodizonates after first evaporating the volatile acids over the steam bath. Titration is done directly in the evaporating dish where a sharp red end point eliminates the need for color comparisons and results in reproducibility to within 0.05 ml. No blank correction is required.

E. M. Rueck

8. GENERAL AND PHYSICAL CHEMISTRY

Oxidation of Hydrocarbon Fuels

Walsh, A. D. PROCESSES IN THE OXIDATION OF HYDROCARBON FUELS.—II. *Trans. Faraday Soc.* (*British*) 43, 297-305 (1947) *June.*

A mechanism of hydrocarbon oxidation is developed. Carbon monoxide formation and the occurrence of a negative temperature coefficient of oxidation rate are explained in terms of intermediate radical formation and decomposition. The occurrence of "cool flames" in hydrocarbon combustion was shown to be due to the presence of excited formaldehyde. Tentatively, and on energetic grounds, a radical-radical reaction is proposed for the formation of the excited formaldehyde.

S. Katz

Walsh, A. D. PROCESSES IN THE OXIDATION OF HYDROCARBON FUELS.—III. *Trans. Faraday Soc.* (*British*) 43, 305-313 (1947) *June.*

The author discusses the mechanism of the "low temperature" combustion of hydrocarbons. This type of combustion is a two stage phenomenon, and frequently is periodic in nature. A reaction mechanism based on the intermediate formation of aldehydes and peroxides gives good agreement with the observed phenomen and is in accord with the conclusions of other authors.

S. Katz

Reaction Rates

Brinkley, S. R. CONTACT TIMES OF CONTINUOUS-FLOW REACTING SYSTEMS WITH VOLUME CHANGE. *Ind. Eng. Chem.* 40, 303-307 (1948) *February.*

A general relation between space velocity and contact time is developed by applying the solutions to the Euler and Lagrange forms of the hydrodynamical steady state equations for the composition of a flow system which undergoes reaction with volume change. Contact times are calculated with this relation for several rate laws. The applications to cases where the rate law is unknown and to flow through a granular bed are discussed.

S. Katz

9. ORGANIC CHEMISTRY

Production of Acetylene

ACETYLENE PRODUCED BY CRACKING METHANE IN REGENERATIVE-TYPE REACTION FURNACE. *Petroleum Processing* 3, 215-218 (1948) *March.*

Ruhr-Chemie in Germany successfully devel-

oped the cracking of methane to acetylene on a pilot plant scale but proposed operating plants were never built. Methane was cracked in a regenerative process with one-minute heating and one-minute cracking cycles at temperatures of 2550-2900°F and at 0.1 atmosphere (76-80 mm Hg) absolute pressure. Reaction time was about 0.01 second and approximately 36% of the methane was converted to acetylene. Methane was burned at atmospheric pressure to preheat the reactor and two reactors were provided so that continuous gas generation was achieved. More than 90% of the carbon formed in cracking was deposited in the reactors and its combustion furnished 37-39% of the total heat. The main disadvantage was the low absolute pressure required by the process.

C. H. Riesz

10. CHEMICAL ENGINEERING

Flow Rates of Gases

Tomlinson, R. H. and Flood, E. A. THE FLOW OF GASES AND VAPORS THROUGH ADSORBING POROUS MEDIA. *J. Canadian Research* **26**, 38-53 (1948) *January.*

Flow rates of gases through activated carbon rods have been studied. Where adsorption is unimportant conformance to the Adzumi equation was found. Peculiar high values were found for flow rates for highly adsorbable vapors. The Adzumi equation is $K = (AP_m/mu) + B\sqrt{T}/M$ where $K = PV/\Delta P$, P is pressure, V is volume, ΔP is pressure drop, P_m is arithmetic mean pressure, mu is viscosity, T is absolute temperature, M is molecular weight, A is a term including the fourth power of the mean capillary radius and B is a term including the third power of the mean capillary radius and the number of capillaries.

J. D. Parent

Fluid Flow

Streeter, V. L. FLUID FLOW AND HEAT TRANSFER IN ARTIFICIALLY ROUGHENED PIPES STUDIED. *Heating, Piping, Air Conditioning* **20**, 96 (1948) *March.*

Some preliminary information as to the nature of the test is supplied. Surface roughness of design of a square thread was selected. One foot lengths of aluminum pipe are being tested. They are joined by means of external threads.

J. D. Parent

Heat Transfer

Leva, M. and Grummer, M. HEAT TRANSFER TO GASES THROUGH PACKED TUBES. *Ind. Eng. Chem.* **40**, 415-419 (1948) *March.*

This represents an effort to evaluate the effect of packing characteristics on heat transfer to gases through packed tubes. Some generalizations of value were obtained.

J. D. Parent

Packed Column Design

Simon, M. J. and Govinda, M. A. METHOD FOR DESIGNING PACKED COLUMNS. *Ind. Eng. Chem.* **40**, 93-96 (1948) *January.*

The authors present a general equation which can be used for evaluating the height of a packed column or for determining the transfer coefficients, in which the method of material transfer from one phase to the other is by diffusion across interfacial films. Examples are offered to show the variation between this equation and those employing the over-all transfer coefficients and over-all H.T.U. values.

H. Dirksen

Thermal Diffusion

Drickamer, H. G. O'Brien, V. J. Bresee, J. C. and Ockert, C. E. THE EFFECT OF CERTAIN COLUMN VARIABLES ON THERMAL DIFFUSION. *J. Chem. Phys.* **16**, 122-128 (1948) *February.*

Tests have been made on two thermal diffusion columns with different annular spacing. The results indicate that the dependence of the separation on temperature and annular spacing predicted by Furry, Jones, and Onsager holds. The dependence on pressure is slightly different than was predicted. The possibility that the index of repulsive force may depend on the pressure is pointed out. Thermal diffusion is defined as the transport of molecules caused by a temperature gradient.

Authors' abstract

Vapor-Liquid Equilibria

Hadden, S. T. VAPOR-LIQUID EQUILIBRIA IN HYDROCARBON SYSTEMS. PART I. *Chem. Eng. Progress* **44**, 37-54 (1948) *January;* PART II. *Ibid* 135-156 (1948) *February.*

A procedure for predicting vapor-liquid equilibria in hydrocarbon systems using ideal equilibrium-vaporization constants or K's is presented in detail. Three nomograms are utilized to correlate the K's over the range of —200°F to 1000°F and for pressures of 10 to 2000 psia. The wide range of materials that can be handled includes hydrogen, light paraffins and mono-olefins up to narrow boiling range cuts boiling at 1100°F. Additional correlations are presented for obtaining the deviation of the K's from their ideal values as the convergence pressure is approached. Correlations are also given for obtaining K's of non-hydrocarbons frequently occurring in hydrocarbon streams either as contaminants or as process materials.

W. K. Zahray

Vapor-Liquid Equilibrium Calculations

Poettmann, F. H. and Rice, R. B. NOMOGRAPHS FOR VAPOR-LIQUID EQUILIBRIUM CALCULATIONS. *Petroleum Refiner* **26**, 128, 129-131 (1947) *December.*

Two nomographs are presented to facilitate the solutions of equilibrium flash vaporization, dew point and bubble point calculations. Examples are given showing the use of each on mixtures containing n components.

H. Dirksen

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Check Valves

Bartlett, H. J. CHECK VALVES, TRAFFIC COPS OF THE PIPE LINES. *Gas Age* **101**, 26-28, 64 (1948) *February* 19.

The two general types of check valves, swing and lift, precautions in installation, and the selection of the proper check for a given job are discussed in this paper. Exceptions to broad rules of selecting check valves are listed and illustrated by specific applications.

J. J. First

Heat Pump

Raber, B. F., Boester, C. F. and Hutchinson, F. W. THE HEAT PUMP. *Heating, Piping*

& Air Conditioning 20, 82-86 (1948) *March.*

The first of a series of papers reporting research on heat pump installations is presented. This article deals with an analysis of the earth as a heat source or as a heat sink. Upon establishing the earth as a source of heat it assumed an infinite plate is imbedded in the soil and a graphical solution for the heat flow is established.

E. F. Davis

Unfired Pressure Vessels

Mattocks, E. D. USE OF UNFIRED PRESSURE VESSELS IN THE LPG INDUSTRY —A SUMMARY. *Oil Gas J.* 46, 112-113 (1948) *March* 11.

The number of unfired pressure vessels used for storage of liquefied petroleum gas exceeds that for any other purpose. The chief difference in design as compared with other vessels are enumerated.

E. F. Davis

Vapor Pressure Controller

Gallagher, G. G. CONTROL OF NARROW-BOILING RANGE FRACTIONATING COLUMNS. *Petroleum Engr.* 19, 82, 84 (1948) *March; Petroleum Refiner* 27, 116-117 (1948) *March; Calif. Oil World* 41, 15, 17 (1948) *February, 2nd issue.*

See *Gas Abstracts* 4, 22 (1948) *January* for abstract.

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Peifer, N. P. CATHODIC PROTECTION OF UNDERGROUND STRUCTURES. *Corrosion* 4, 6-9 (1948) *February.*

By the use of soil potential, resistivity, and current flow hetween pipe and soil tests, and by carefully analyzing the data collected, one can locate positions where cathodic protection is needed. The cathodic protector recommended by the author is Galvoline, a magnesium ribbon, that is plowed under adjacent to the pipe line and connected to it by means of iron wire, at regular intervals.

S. Mori

Corrosion

Nelson, A. C. CONTROL OF EXTERNAL CORROSION ON PLANTATION PIPE LINE. *Corrosion* 4, 123-131 (1948) *March.*

Corrosion control of the Plantation Pipe Line is divided into the following phases: (1) pumphouse stations, (2) storage tank bottoms, (3) the main pipeline, (4) areas in vicinity of stray currents. An analysis of cost and other influencing factors in choosing either the rectifier type or the galvanic anode type of a protector is given for each of the first three phases, while for the fourth phase a special type of a copper oxide rectifier is recommended.

S. Mori

13. NEW BOOKS

Pressure Vessels

Spring, Harry M., Jr. PRESSURE VESSELS FOR INDUSTRY. New York, McGraw-Hill, 1947.

The author summarizes the processes that form a basis for the pulp and paper, rubber, textile, and chemical industries and includes typical flow sheets. However, the references to and descriptions of various high pressure equipment used in these industries are not extensive. The design of pressure vessels is approached in a general manner with some typical pressure and stress calculations, and in this section; references to the A.S.M.E. codes are liberal. Construction and typical fabrication practices such as low temperature stress relief, corrosion linings, and multilayer construction of some of the large equipment manufacturers are described. Basic instruments for the control and measurement of pressure, temperature and flow are commented upon and the placing and usage of pressure and temperature relief devices is discussed with the author's recommendations. A chapter devoted to inspection methods used in the detection of deterioration and the prevention and repair of corrosion damage, also describes the cause of some explosions and other serious failures. This book should be useful when a general, not highly technical, approach to the subject of pressure vessels is wanted.

W. K. Zahray

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